



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/772,153

02/04/2004

Shilin Chen

SC-03-01

1857

29106

7590

11/27/2006

GROOVER & HOLMES

BOX 802889

DALLAS, TX 75380-2889

EXAMINER

FERRIS III, FRED O

ART UNIT

PAPER NUMBER

2128

DATE MAILED: 11/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/772,153

Applicant(s)

CHEN, SHILIN

Examiner

Fred Ferris

Art Unit

2128

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>11/26, 4/9, 4/7, 4/5</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. *Claims 1-39 have been presented for examination based on applicant's disclosure filed 4 February 2004. Claims 1-39 are currently pending in this application and stand rejected by the examiner.*

Claim Interpretation

2. *Applicants have disclosed a method for designing roller cone drill bits that includes simulating multiple design parameters of a bit drilling a formation and adjusting the design parameters by "multi-objective" optimization were objectives relating to maximizing rock removal, equalizing rock removal among elements, and minimizing shock load and tracking components. The examiner has interpreted the term "multi-objective optimization", as best understood from applicants disclosure, to mean energy balancing of the roller cone bit forces (paragraph, 0177) using optimization techniques known in the engineering art (such as disclosed by: Gembicki, 1974, Grace, 1989), including Weighted Sum Method, the Single Objective Method and the Goal Attainment Method (paragraph, 0216).*

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-8, 17-24, and 33-39 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement.

The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Specifically, independent claims 1, 17 and 33 included the limitation “simulating operation of a drill bit multiple design parameters through a formation to be drilled”, that does not appear to be enabled by the specification. While the specification contains a teaching of parameters relating to adjusting multiple bit design parameters in designing roller cone drill bits, it appears to be completely silent on the claimed simulating operation of a drill bit having these multiple design parameters through a formation to be drilled.

Dependent claims inherit the defect of the claims from which they depend.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 9-16, and 25-32 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01.

Specifically, independent claims 9 and 25 recite a method designing roller-cone drill bits by adjusting multiple bit design parameters using multi-objective optimization combining the objectives of sub-elements. These claims appear incomplete since the

there appears to be no result or application relating to the bit design from the combination of the objectives. Further, the claim is not consistent with the design process as disclosed in Figure 1. (e.g. there is no redesign of the bit using optimized parameters, or test for a successful optimization, See: 1016, 1018)

The omitted steps are: test for a successful optimization, and redesign of the bit using optimized parameters. (Note: in contrast independent claims 1 and 17 include repeating several iterations of optimization and outputting the results)

5. Claims 8, 16, 24, 32 and 39 are further rejected under 35 U.S.C. 112, second paragraph, as failing to provide antecedent basis for the claimed subject matter.

Specifically, claims 8, 16, 24, 32 and 39 recite the limitation "method of drilling" in independent claims 1, 9, 17, 25, and 33 respectively. There is insufficient antecedent basis for this limitation in the claim. Specifically, independent claim 8, 16, 24, 32 and 39 are drawn to a method of designing roller-cone drill bits by optimization. There does not appear to be any basis for support of the limitations relating to a method for drilling in the independent claims.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

6. Claims 9-16, and 25-32 are rejected under 35 U.S.C. 101 because the claimed invention is drawn to non-statutory subject matter.

Per independent claims 9 and 25: The Examiner submits that, in view of the language of the claims, method claims 9 and 25 do not appear to recite a concrete and tangible result. The examiner submits that in order to establish a practical application, there must be either a physical transformation, or a useful, concrete and tangible result. Data transformation is not the same as a physical transformation. In this instance, there does not appear to be a concrete and tangible result. Here, the method steps for "designing roller-cone drill bits" only appears to result in a range of optimized parameters (numbers) resulting from the recited "adjusting". This is simply a mathematical computation resulting in an un-stored and un-applied number, not a physical transformation. The claimed "adjusting multiple bit design parameters by reference to a multi-objective optimization", in this case, is a thought or computation, and not in and of itself a concrete and tangible result. It is not until the result is applied in a meaningful way that it has real world value and becomes a concrete and tangible result. For example, there does not appear to be a concrete and tangible result that is specifically applied to achieve the drill bit design as recited in the preamble.

MPEP 2106 recites the following:

"A. Identify and Understand Any Practical Application Asserted for the Invention
The claimed invention as a whole must accomplish a practical application. That is, it must produce a "useful, concrete and **tangible result**." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601-02. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of "**real world**" value, as opposed to subject matter that represents nothing more than an idea or concept, or is simply a starting point for future investigation or research (Brenner v. Manson, 383 U.S. 519, 528-36, 148 USPQ 689, 693-96); In re Ziegler, 992, F.2d 1197, 1200-03, 26 USPQ2d 1600, 1603-06 (Fed. Cir. 1993)). Accordingly, a complete disclosure should contain some indication of the practical application for the claimed invention, i.e., why the applicant believes the claimed invention is useful.

Apart from the utility requirement of 35 U.S.C. 101, usefulness under the patent eligibility standard requires significant functionality to be present to satisfy the useful result aspect of the practical application requirement. See Arrhythmia, 958 F.2d at 1057, 22 USPQ2d at 1036. Merely claiming nonfunctional descriptive material stored in a computer-

Art Unit: 2128

readable medium does not make the invention eligible for patenting. For example, a claim directed to a word processing file stored on a disk may satisfy the utility requirement of 35 U.S.C. 101 since the information stored may have some "real world" value. However, the mere fact that the claim may satisfy the utility requirement of 35 U.S.C. 101 does not mean that a useful result is achieved under the practical application requirement. The claimed invention as a whole must produce a "useful, concrete and tangible" result to have a practical application.

Although the courts have yet to define the terms useful, concrete, and tangible in the context of the practical application requirement for purposes of these guidelines, the following examples illustrate claimed inventions that have a practical application because they produce useful, concrete, and tangible result:

- Claims drawn to a long-distance telephone billing process containing mathematical algorithms were held to be directed to patentable subject matter because "the claimed process applies the Boolean principle to produce a useful, concrete, **tangible result** without pre-empting other uses of the mathematical principle." AT & T Corp. v. Excel Communications, Inc., 172 F.3d 1352, 1358, 50 USPQ2d 1447, 1452 (Fed. Cir. 1999);*
- "[T]ransformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces a useful, concrete and tangible result' -- a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601; and*
- Claims drawn to a rasterizer for converting discrete waveform data samples into anti-aliased pixel illumination intensity data to be displayed on a display means were held to be directed to patentable subject matter since the claims defined "a specific machine to produce a useful, concrete, and **tangible result**." In re Alappat, 33 F.3d 1526, 1544, 31 USPQ2d 1545, 1557 (Fed. Cir. 1994).*

In this case, independent claims 9 and 25 do not appear to be concrete and tangible since the result is merely a calculated numerical representation of parameters based on "optimization" that is not specifically concretely stored, displayed, or used to complete the representative drill bit design as recited in the preamble. Dependent claims inherit the defects of the claims from which they depend.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

Art Unit: 2128

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over “The Operational Mechanics of The Rock Bit”, Ma et al, Petroleum Industry Press, Copyright 1996 (of record) in view of applicants own admission (AOA).

Per independent claims 1, 9, 17, and 25: Ma et al discloses techniques for optimizing the design of a roller bit (chapter 6) drilling a simulated earth formation (chapter 5), the operational mechanics (e.g. design parameters) of roller bit geometry and cutting elements (chapter 2, 6.1), the kinematics of the bit (teeth, rollers, scraping formation, etc. chapter 3), rock and bit interaction (volume, etc. chapter 5), and bit design and force analysis (optimize using computer simulation by size, load, motion, stress, etc. chapter 6, section 5.4, especially page 232, based on the entire teachings).

While Ma does teach optimization of roller-cone drill bit design by considering the effects of multiple design parameters, Ma is silent on the specific use of multi-objective optimization.

However, by applicant's own admission, the present invention incorporates multi-objective optimization techniques known in the engineering art (such as disclosed by: Gembicki, 1974, Grace, 1989), including Weighted Sum Method, the Single Objective Method and the Goal Attainment Method (specification: paragraph, 0206).

It would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the teachings of Ma relating to optimizing the design of a roller bit, drilling a simulated earth formation, and the operational bit

mechanics parameter, with the teachings of AOA specifically relating to multi-objective optimization techniques as known in the engineering art (such as disclosed by: Gembicki, 1974, Grace, 1989), to realize the claimed invention. An obvious motivation exists since, in this case, and as recognized by applicants, multi-objective optimization permits various (design) factors to be taken into account in a balanced way and simplifies the overall complicated roller-cone bit design process. Accordingly, a skilled artisan having access to the teachings of Ma and the multi-objective techniques of AOA, would have knowingly modified the teachings of Ma with the teachings of AOA (or visa versa) to realize the claimed elements of the present invention and thereby simplify the overall complicated roller-cone bit design process.

Per dependent claims 2-6, 10-14, 18-22, 26-30: *Ma sets forth maximizing penetration rate (roller cone penetration Chapters 2-5, Section 6.1) by design, bit (shock) loading (5.4, especially page 232) on components, distance of cutting teeth (Ma discloses contacting teeth effects, page 95, paragraph 1) and the importance of balancing forces ob bit components (3.3). (e.g. Ma sets forth a model to find the "optimum" set of design parameters, and that the bit energy should be in balance 3.3, as well as the load distribution to parts (e.g. rollers), 6.2.1))*

Per claims 7, 8, 15, 16, 23, 24, 31, 32, 38, 39: *Ma discloses bit designs and drilling resulting from an optimization of design parameters (Chapters 2, 3, 5 and 6, Fig. 2-1).*

Regarding independent claim 33: *Claim 33 includes limitations related to reading initial optimization information (e.g. parameters) and simulating drilling a formation*

Art Unit: 2128

which are rendered obvious in view of Ma as cited above (i.e. optimizing the design of a roller bit (chapter 6) drilling a simulated earth formation (chapter 5), the operational mechanics (e.g. design parameters) of roller bit geometry and cutting elements (chapter 2, 6.1)) The generation of design constraints and bound (limitations) would further be obvious in view of Ma's new method teaching for optimizing design performance parameters disclosed in sections 6.1.1, 6.1.2, and 6.2. Ma further teaches both 2D and 3D bit interactions models (chapters 2, 3, 6, especially 2.2, 3.1) As also cited above, multi-objective optimization techniques were known in the engineering art at the time of the invention, and hence would have been knowingly combined by a skilled artisan to realize an "algorithm for optimization" using the same reasoning previously set forth above.

Regarding claims 34-37: Ma teaches the effects of tooth length and range including orientation angle and clearance (2.2, 3.1) and the resulting effects on formation cutting (Sections 3.3 - 3.5, pages 94-105, Figs. 3-10, 3-11).

Conclusion

8. *The prior art made of record and not relied upon is considered pertinent to applicant's disclosure, careful consideration should be given prior to applicant's response to this Office Action.*

"Design Considerations for a Hard-Rock PDC Drill Bit, Glowka, SAND-85-066C, OSTI 1985 teaches optimizing design of roller-cone drill bits.

Art Unit: 2128

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fred Ferris whose telephone number is 571-272-3778 and whose normal working hours are 8:30am to 5:00pm Monday to Friday. Any inquiry of a general nature relating to the status of this application should be directed to the group receptionist whose telephone number is 571-272-3700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached at 571-272-2279. The Official Fax Number is: (571) 273 8300

Fred Ferris, Primary Examiner
Simulation and Emulation, Art Unit 2128
U.S. Patent and Trademark Office
Randolph Building, Room 5D19
401 Dulany Street
Alexandria, VA 22313
Phone: (571-272-3778)
Fred.Ferris@uspto.gov
November 22, 2006

Fred Ferris
FRED FERRIS
PRIMARY EXAMINER
TECHNOLOGY CENTER 2100